

HOLARCTIC TRIBES OF THE ICHNEUMON-FLIES OF THE
SUBFAMILY ICHNEUMONINAE (PIMPLINAE).

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INTRODUCTION.

This paper, which is a joint contribution of the Branch of Deciduous Fruit Insect Investigations and the Branch of Forest Insects of the Bureau of Entomology, is the result of study extending over a period of several years, and embodies the opinion of the authors as to the relationship and number of tribes of the Ichneumoninae (Pimplinae Authors) as represented in the Holarctic region. As originally planned, we had hoped to prepare a joint paper on the entire group, but since, because of interruptions by other work, such a paper is found impracticable we have considered it advisable to present a tribal synopsis as a basis for subsequent revision of the minor groups.

The change of the subfamily name is necessary because the type of the genus *Ichneumon* is *Ichneumon manifestator* Linnaeus¹ and has as synonyms the isogenotypic genera *Pimpla* Fabricius and *Ephialtes* Gravenhorst (not Schrank).² The subfamily name Pimplinae must therefore be suppressed in favor of Ichneumoninae and the subfamily Ichneumoninae of authors will be Joppinae after the name of the oldest included genus.

HISTORICAL.

The beginning of the classification of the Ichneumoninae dates of course from Linnaeus, but since the writers preceding Gravenhorst

¹ Morice and Durrant, (Trans. Ent. Soc. Lond., 1914, p. 388) contend that the type of the genus *Ichneumon* is *Ichneumon persuasorius* Linnaeus, a species given by Lamarek (1801) as an example for the genus *Ichneumon*. We can not agree with them in this nor do we believe that the rulings in the Code of International Zoological Nomenclature will uphold the acceptance of the Lamarekian examples as type designation. The code specifically says "The meaning of the expression 'select a type' is to be rigidly construed. Mention of a species as an illustration or example of a genus does not constitute a selection of a type." Lamarek and most of the older writers, including most of Latreille's works, gave examples only as an illustration of the genus and not as a type designation.

² See Cushman and Rohwer, Proc. Ent. Soc. Wash., vol. 20, 1919, p. 186.

had done little more than describe genera and species they contributed only slightly to the taxonomy of the group and it is not necessary to discuss their work in detail.

From the beginning the classification of the Ichneumoninae has been rendered unsatisfactory and difficult by the exclusive employment of characters of such nature that they apply to but one sex, or are conspicuous only in more or less extreme types, while absent or inconspicuous in other genera obviously closely allied. In addition all recent classifications have followed very closely that of Foerster which was based almost entirely on Holarctic genera, and the attempt to adapt this arrangement to the genera of the world has added much to the confusion.

Gravenhorst.—In 1829 Gravenhorst¹ published the first real attempt at the classification of the Ichneumonidae. He divided the family into thirteen genera. Most of these he subdivided into a number of families or subgenera to which he gave names, and some few of these he further divided into unnamed groups which he called sections. All of Gravenhorst's subgenera and many of his sections have since been raised to generic rank.

Of the genera treated by Gravenhorst as subgenera that are here placed in the subfamily Ichneumoninae, seven, *Glypta*, *Lissonota*, *Polysphincta*, *Clistopyga*, *Pimpla*, *Ephialtes*, and *Rhyssa*, he considered as subgenera of *Pimpla*. As subgenera of *Pimpla* Gravenhorst also included *Schizopyga* and (*Trachyderma*) = *Tylocomnus*, both now placed in the subfamily Tryphoninae. *Xorides*, *Xylonomus*, *Odontomerus*, and the Cryptine genus *Echthrus* constituted his genus *Xorides*. *Coleocentrus* and *Arotus* were the unnamed subgenera IV and VI respectively of his genus *Banchus*. *Phytodietus* he placed as subgenus VIII of *Cryptus*. *Acoenites* formed a genus by itself without subdivisions.

Gravenhorst's key is in the form of a chart classifying the insects down to subgenera, which are bracketed into their genera. The characters employed are mostly superficial, indefinite, or unisexual and have largely persisted up to the present for the major divisions within the group.

Holmgren.—Holmgren² separated the Ichneumonidae into five families corresponding to the usual five subfamilies. He made no key to these families, but gave a rather long description of each, mentioning nearly all parts.

¹ J. L. C. Gravenhorst, *Ichneumonologia Europaea, Vratislaviae, Sumtibus Auctoris*, 1829, vol. 1, pp. 1-xxxiii, 1-827; vol. 2, pp. 1-939; vol. 3, pp. 1-1097.

² A. E. Holmgren, *Försök till Uppställning och Beskrifning af de i Sverige Funne Tryphonider, Konigliga Svenska Vetenskaps-Akademiens Handlingar*, 1855, pp. 93-394, 2 pls.

In 1859¹ he published his first synopsis of his family Pimplariæ. This he divided into two main sections which he called Pimplariæ and Xorides, the latter corresponding to the tribe Xoridini of Ashmead, and the former including genera since divided into the tribes Acoenitini, Lissonotini, and Pimplini. His main divisions are based on practically the same characters as those used by Gravenhorst, while those of the smaller divisions were new and still largely persist in the more recent keys. The generic descriptions are full and detailed, and the Swedish species are listed under each genus. In the following year he published a larger work² in which the generic key is largely reprinted from the earlier paper, but each Swedish species is discussed in considerable detail. His two main sections are here called subfamilies.

Cresson.—The first American writer to take more than a general interest in the Hymenoptera was Cresson, who in 1887 published his *Synopsis*.³ For this work Cresson claims little originality, confessing to having compiled his keys from the writings of previous authors. He did, however, a valuable work in marshaling the known North American species and added much to the knowledge of the group in America.

Cresson's key to the Pimplinæ is much easier to use than most others. He, however, made no attempt to divide the subfamily into tribes nor to express by his key the relationship of the genera to each other. His specific keys, based largely on color, are useful, although too much reliance must not be placed on characters of this sort.

Foerster.—A few years after Holmgren had published his synopsis Foerster⁴ produced his system of classification of the Ichneumonidae. In this work he divided the group into 34 coordinate families, 4 of which, the Pimplidae, Lissonotidae, Acoenitidae and Xorididae, together with Ashmead's tribe Labenini, constitute the five tribes into which Ashmead divided the subfamily Pimplinæ. The Xorididae represent Holmgren's section II; the Acoenitidae, section I, division 1; the Pimplidae, section I, division 2, phalanges 1 and 2; and the Lissonitidae, section I, division 2, phalanx 3.

¹ A. E. Holmgren, *Conspectus Generum Pimpliarum Suecia, Öfversigt af Koniglga Svenska Vetenskaps-Akademiens Förhandlingar*, vol. 6, 1859, pp. 121-132.

² A. E. Holmgren, *Försök till Uppställning och Beskrifning af Sveriges Ichneumonider, Monographia Pimpliarum Sueciae, Koniglga Svenska Vetenskaps-Akademiens Handlingar*, vol. 3, No. 10, 1860, pp. 1-76.

³ E. T. Cresson, *Synopsis of the Families and Genera of the Hymenoptera of America North of Mexico, 1887, supplementary volume of Trans. Amer. Ent. Soc.*, pp. i-vi, 1-350.

⁴ Arnold Foerster, *Synopsis der Familien und Gattungen der Ichneumoniden, Verh. nat. hist. Ver. preuss. Rheinl.*, vol. 25, 1868, pp. 142, 162-170.

For his larger divisions Foerster used many of the old Gravenhorstian characters supported by those of Holmgren, but added many new ones to define his much finer subdivisions. He tabulated and named many new genera, most of them without further diagnosis and without including any species or designating types. This, together with the extremely minute differences which Foerster considered of generic value, makes the determination of his genera very difficult. Indeed, many of them stand to-day without included species. The difficulties in this respect are perhaps less in the Ichneumoninae than in almost any other group, although even there one must exercise considerable liberality in the interpretation of characters to satisfactorily place a species in its genus.

Practically all authors since Foerster have followed him very closely. Especially is this true of Ashmead and Schmiedeknecht whose keys are largely translations or adaptations of Foerster, with new genera and new characters interpolated occasionally.

Foerster's work, left unfinished as it was, has thrown much light on the classification of the Ichneumonoidea, but because of his unsupported use of unisexual and variable characters it has also added much to the confusion of this difficult group.

Thompson.—In his treatment of the Ichneumoninae in his *Opuscula Entomologica* Thomson¹ followed largely the System of Holmgren. He published no tribal nor generic tables, but his keys to species abound in new and useful characters. It is indeed unfortunate that Thomson did not apply his clear insight to an attempt to clarify the classification of the Ichneumonidae as a whole. No other worker has appreciated as did he the extent of variation in the group or the little dependence that can be placed in the superficial characters used for the separation of the larger groups.

His contributions concerning the Ichneumoninae are scattered through several fascicles of his *Opuscula Entomologica* and consist largely of keys to Swedish species and observations on those species.

Davis.—In presenting his review of North America Tryphoninae Davis² gives, without grouping them into subfamilies, a synopsis of the tribes of the Ichneumonidae. This synopsis follows very closely (so closely in fact that up to couplet 10 it is a translation) Foerster's key of the natural families of Ichneumonidae, and has its use mainly in being its author's interpretation of Foerster and in giving a definition of the tribes he treats.

¹ C. G. Thomson, *Opuscula Entomologica*, Lund, fascicles 5, 8, 9, 12, 13, 19, and 21, 1873-1896.

² G. C. Davis, A Review of the Ichneumonid subfamily Tryphoninae, 1897, *Trans. Amer. Ent. Soc.*, vol. 24, pp. 193-348.

Ashmead.—Ashmead¹ in his treatment of the Ichneumoninae groups together, and considers as tribes, Foerster's families Acoenitoidae, Lissonotoidae, Pimplidae, and Xoridoidae and adds the tribe Labinini, a group not represented in Europe. In his method of treatment and in his choice of characters Ashmead follows very closely the work of Foerster, and in the main his paper is a translation of Foerster with the addition of new and a subsequently described genera. Many of the characters are taken only from the female, which makes it impossible to satisfactorily place males, and the venation is used extensively. The shape and presence or absence of the areolet is used repeatedly as a primary character and much value is attached to the angulation of the discocubitus, the presence or absence of a ramulus, the position of the nervulus, and the point of fracture of the nervellus. In fact the entire classification is founded on an insufficient and superficial study of a few types. The characters offered will not apply to all of the species which were placed in the various genera as arranged in Ashmead's collection or that of the United States National Museum as it was arranged by him. Unsatisfactory as his classification is, it has been useful because it brought together and gave some characters for the numerous genera described up to 1900. It must be remembered, however, that Ashmead endeavored to include all the described genera, and in a number of cases was forced to use only the descriptions which are frequently insufficient and offer only characters that are often of questionable value.

Schmiedeknecht.—The treatment of the subfamily Ichneumoninae as given by Schmiedeknecht² in the *Genera Insectorum* adds but little information which will aid in the satisfactory classification of these insects. The work is founded, in great part, on that of Foerster and Ashmead, and is a conservative adaptation of their work with the recently described genera included. There are, however, some transfers of genera and in some places certain groups which Ashmead treated as genera are treated as subgenera, yet many of the mistakes made by Ashmead are copied and the same kind of characters are used. It is, however, a useful work and if it shows but little originality we can perhaps excuse the author because of the difficulty of the group, the area covered, and the lack of representatives of many of the genera.

¹ W. H. Ashmead, Classification of the Ichneumon Flies, or the Superfamily Ichneumonoidea, Proc. U. S. Nat. Mus., vol. 23, 1900, pp. 1-220.

² Otto Schmiedeknecht, Subfamily Pimplinae, Gen. Ins., fasc. 62., 1907, pp. 1-120, pls. 1-2.

Morley.—Claude Morley in his recent papers¹ dealing with the insects grouped together as the subfamily Ichneumoninae has offered a number of new suggestions in arrangement and expressed a doubt that all the members are closely related, as the following quotation (1a, p. xv) will show: "That the Lissonotides have any close relationship with the typical Pimplides I do not for a moment believe; the Acoenitides, as at present grouped, are very heterogeneous; and the Banchides are admittedly aberrant, wherever placed; while the Xoridides, though related to some extent in their thoracic structure with *Rhyssa*, appear worthy of ranking as a distinct subfamily."

In 1908 (1a) Morley adds the tribe Banchides to his subfamily Pimplinae and in 1913 (1b) he raises the genus *Rhyssa* and allies to tribal rank (in 1908 he still had this group in the Pimplini) and makes a tribe, Ecthromorphides, for the genera *Lissopimpla* and *Ecthromorpha*. This last tribe is an arbitrary grouping on two variable venational characters and the lengthening of the malar space, the latter so variable as to be of doubtful generic value.

In his definition of the subfamily Pimplinae (1a, p. xvi) he makes use of a secondary sexual character and adds in a qualifying way an extremely variable specific character. The key to the tribes (1a, p. 1) makes use of some of the usual characters and one is at a loss to know how the Theronini can be placed in the Pimplides as he defines them. It would seem that Morley has done but little more than offer a rearrangement of names, for when he has given additional characters they are usually of such nature as to be subject to individual variation or are unisexual and should not be used, unsupported, as prime characters of genera or higher groups.

It must not, however, be implied that we would belittle the work of Morley, because with all its shortcomings it is very useful and clears up many obscure points about the species which are represented in the British Museum by type material, and gives useful keys to distinguish the material in that museum.

Viereck.—In the recent synopsis of the genera of Ichneumon flies of Connecticut, Viereck,² does away with subfamily divi-

¹ (a) Claude Morley, *Ichneumonologia Britannica III. The Ichneumons of Great Britain, etc., Pimplinae*, 1908, H. and W. Brown, London, England, pp. i-xvi, 1-328.

(b) Claude Morley, *A revision of the Ichneumonidae Based on the collection of the British Museum, part 2, Tribes Rhyssides and Ecthromorphides*, 1913, London, pp. i-vi, 1-48.

(c) Claude Morley, *Idem.*, part 3, tribe Pimplides, 1914, pp. i-viii, 1-122.

(d) Claude Morley, *Idem.*, part 4, tribe Banchides, 1915, pp. ix-x, 135-151.

² H. L. Viereck, *The Hymenoptera, or Wasp-like Insects, of Connecticut*, 1917, *Bull. 22, Geol. and Nat. Hist. Survey Conn.*, pp. 243-326.

sions,¹ and, after removing the closely allied genus *Banchus* on a character subject to specific variation, he separates the genera belonging to the Ichneumoninae as here defined from the other genera of the Ichneumonidae in much the same unsatisfactory manner as that of Ashmead, and in many places only on secondary sexual characters. There are, however, a few new characters, and the work has contributed something to render the Ichneumoninae of the limited region somewhat better understood.

CLASSIFICATION.

In presenting this revision of the subfamily Ichneumoninae we do not wish to be construed as expressing an opinion that it is a natural group. The family Ichneumonidae is a group composed of elements showing remarkable differences but at the same time extreme homogeneity. So true is the latter that the grouping into five universally recognized subfamilies is, in our opinion, untenable. The published keys for the separation of these five subfamilies leave the placing of a species in its proper subfamily almost entirely to the imagination or experience of the worker. On the other hand, the strict interpretation of such characters as these keys offer frequently leads even the experienced taxonomist to entirely misplace an insect; and disagreement among workers as to the allegiance of certain genera or groups of genera is very frequent. The Plectiscini, Banchini, and Paniscini are notable as bones of contention, while all of the subfamilies, notably the Tryphoninae and Ophioninae, are aggregations of groups not at all closely allied but thrown together on such superficial characters as compression or depression of abdomen, long or short ovipositor, possession or lack of sternauli, shape, presence or absence of the areolet, etc. Anyone who has studied the insects of this group in an at all intensive manner knows that such characters as these are valueless as used in the keys, and he also knows that in determining species he places them in the subfamilies without regard to the characters of the keys but entirely from his knowledge of genera.

The subfamily Ichneumoninae, as treated here, is practically the same as the subfamily Pimplinae in the sense of Holmgren, Cresson, Ashmead, and others, with a genus here and there rejected as not referable to the subfamily. We have adopted this restriction of the subfamily as a matter of convenience and in accordance with the

¹ Since the above was written Viereck has (Proc. Biol. Soc. Wash., vol. 31, 1918, p. 69) elevated all of the tribes of the Ichneumonoidea to subfamily rank for the very naive reason, "to avoid confusion in referring to groups of genera by word of mouth." In Ent. News, vol. 31, 1920, p. 16, he makes a family for the genera *Labena* Cresson, *Apechoneura* Kreichbaumer, and *Psiloparia*, new genus. The value of this grouping has been discussed by Cushman, Proc. Ent. Soc. Wash., vol. 22, no. 4, 1920.

project as originally conceived, which was to revise the North American Pimplinae.

It seems very probable that the Ichneumoninae as here treated is composed of a number of phylogenetic branches, associated by more or less similarity of habitus and superficial structure, and forming a group which, because of its discordant elements, is so closely related to groups in other subfamilies as to make definition of it as a unit extremely difficult if not impossible. The same is true, to greater or less extent, of the other four subfamilies. Because of this, it does not seem advisable to offer any other definition of the limits of the subfamily Ichneumoninae than to say that this tribal synopsis is based on the Pimplinae as limited by Ashmead and the genera described since 1900. The student unfamiliar with these insects will therefore necessarily have to refer to the unsatisfactory definitions offered by Ashmead, Cresson, and others.

In spite of the probable diversity of origin of the tribes, constant diagnostic characters are very rare, and our keys to the tribes include the most available characters. Not all of these characters taken singly are of tribal value; in fact such characters are very rare in the Ichneumonidae. It is rather an assemblage of characters, which taken together form the peculiar structure and habitus that distinguish the members of one tribe from those of another.

The remarks in regard to the subfamilies set forth above are equally applicable to the usual five tribes of the Ichneumoninae. None of the existing keys to these tribes is usable by the beginner in the taxonomic study of these insects unless he has access to an extensive named collection for comparison. This is due partly to the attempt of the authors of the keys to place all the genera in the five tribes originally proposed by Ashmead; partly to the use of extreme or unisexual characters unsupported by characters applying to the other sex, or of those variable within a genus, or the positive statement of characters that do not apply to all species placed in a given tribe; and partly to a too superficial study of the species, or, when careful study has been made, a laissez-faire policy of not attempting a revision of the keys. In other words, in order to run a given species to its genus one must be able from the knowledge gained only by long experience to tell at once the tribe to which the species should be referred. The tribal keys, being unusable by the beginner and unnecessary to the experienced, are useless, or worse (so far as the beginner is concerned), misleading.

We are convinced that the entire biology and the characters displayed by all stages are of importance as indicating relationship or divergence and that whatever of this sort of information is available should be taken advantage of as a guide to classification. In pro-

posing the following arrangement of tribes we have therefore taken into consideration what we know of larval structure, nature of the host, and relation of parasite to host. We have found that the structure of the ovipositor and of the terminal segments in the female have been developed similarly in genera which have similar larval structures and host relations. These characters in the female are of such nature that they can be easily seen and expressed briefly and positively. We have therefore considered it advisable to present a key based entirely on the female, making use of sexual and secondary sexual characters. We recommend the use of this key to beginners and others unfamiliar with the group and believe that less difficulty will be experienced in its use than in the use of the key in which the secondary sexual characters are eliminated. This last mentioned key, while not entirely satisfactory, serves to distinguish the tribes which we believe to be represented among the genera studied and sets forth the best characters applicable to both sexes.

There are three new terms which are used in this paper, and the authors expect to make use of these terms in future works. They may be defined as follows:

A perpendicular nervellus (fig. 1, *f*, *g*) is one in which the anterior end is opposite the posterior end, that is, one in which a line drawn touching both the anterior and posterior ends is at right angles to the longitudinal axis of the submedial cell. Other authors have called this a continuous or interstitial nervellus.

An inclivous nervellus (fig. 1, *d*, *e*) is one in which the anterior end is nearer the base of the wing than is the posterior end. This has heretofore been spoken of as an antefurcal nervellus.

A reclivous nervellus (fig. 1, *a*, *b*, *c*) is one in which the posterior end is nearer the base of the wing than is the anterior end. This has heretofore been spoken of as a postfurcal nervellus.

We have substituted the terms inclivous and reclivous for the ambiguous and unsatisfactory terms antefurcal and postfurcal; and have adopted the less used term perpendicular because we believe that it is less confusing and more in keeping with the terms inclivous and reclivous. The terms interstitial, antefurcal, and postfurcal are used in the usual sense for such veins as the nervulus and recurrens and in this sense are easily understood and in keeping with the exact meaning of the words.

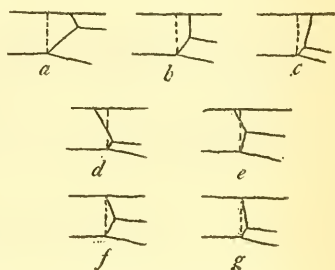


FIG. 1.—NERVELLI: *a*, *b* AND *c*, RECLIVOUS; *d* AND *e*, INCLIVOUS; *f* AND *g*, PERPENDICULAR.

KEY TO TRIBES BASED ON FEMALES.

1. Ovipositor with a dorsal notch a short distance back from apex; (internal parasites of Lepidopterous larvae), fig. 2. 2.

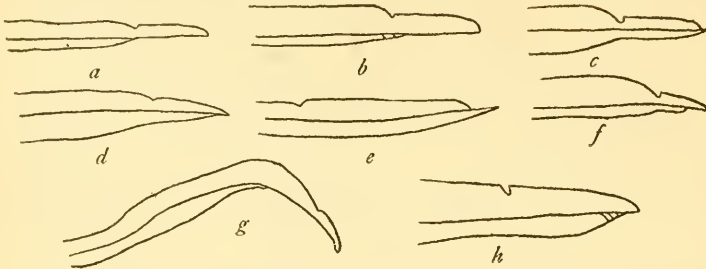


FIG. 2.—APICES OF OVIPOSITORS: a, GLYPTA SIMPLICIPES CRESSON; b, LAMPRONOTA AMERICANA CRESSON; c, ARENETRA NIGRITA WALSH; d, MENISCUS SCUTELLARIS CRESSON; e, CYLLOCCERIA LUGUBRIS CRESSON; f, LAMPRONOTA FRIGIDA CRESSON; g, LISSONOTA VERBERANS GRAVENHORST; h, AMERSIBIA PRIONOXYSTI ROHWER.

- Ovipositor without such a notch.
 2. Tergites without oblique furrows. *Lissonotini*.
 Tergites with oblique furrows extending from basal middle to near apical margin. *Glyptini*.
 3. Tarsal claws pectinate; apex of ovipositor spear-head like; (parasites of Lepidopterous larvae), fig. 3. 4.

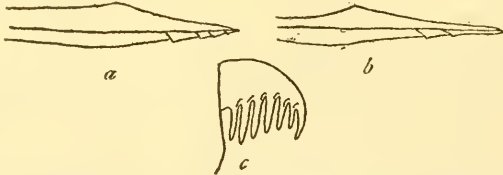


FIG. 3.—APICES OF OVIPOSITORS: a, TOXOPHORIDES ALBOMARGINATA (CRESSON); b, PHYTODIETUS BURGESSI CRESSON. HIND TARSAL CLAW: c, PHYTODIETUS BURGESSI CRESSON.

- Tarsal claws simple or with a large basal tooth or lobe, fig. 4. 5.



FIG. 4.—HIND TARSAL CLAWS: a, ITOPLECTIS CONQUISTOR (SAT); b, ICHNEUMON IRRITATOR FABRICIUS.

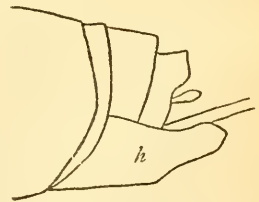


FIG. 5.—APEX OF FEMALE ABDOMEN OF TOXOPHOROIDES ALBOMARGINATA (CRESSON) (h=HYPOPYGIUM.)

4. Tergites 1-4 with oblique and apical transverse furrows and strongly sculptured; scutellum margined laterally; hypopygidium heavily chitinized and extending to or beyond apex of abdomen, fig. 5. *Lycorini*.
 Tergites without furrows and polished; scutellum not margined; hypopygidium neither especially heavily chitinized nor prominent. *Phytodietini*.

5. Ovipositor short, never more than half as long as abdomen, compressed, with a distinct swelling below at or about the middle, beyond which it tapers to a very acute point; clypeus strongly convex, rounded at or most truncate at apex, never medially impressed or inflexed; last tarsal joints swollen, claws and onychia very large, all claws with basal tooth; face narrow, convergent below; mandibles narrow at apex, upper tooth much the longer; areolet only rarely defined; (external parasites on spiders), fig. 6..... *Polysphinctini*.



FIG. 6.—APICES OF OVIPOSITORS: a, *POLYSPHINCTA TEXANA* CRESSON; b, *HYMENOEPIMECIS WILTHI* (CRESSON); MANDIBLE: c, *HYMENOEPIMECIS WILTHI* (CRESSON).

- Ovipositor either short or long, but never formed as above; clypeus most frequently impressed and emarginate medially, occasionally inflexed and truncate or rounded at apex; apical tarsal joints rarely swollen or with large claws and onychia; mandibles either broad and bidentate at apex with equal teeth or acute and edentate, in the latter case rarely with a small inner tooth.... 6.
6. Ovipositor never nearly as long as body, cylindrical, or nearly, occasionally depressed or decurved at apex; claws simple, without a basal lobe or tooth, occasionally (*Itoplectis*) with claws of front tarsi lobed or (*Apechthis*) all or front and middle claws lobed, in the last genus the ovipositor is decurved at apex; notauli either absent to obsolete or very deep and pit-like anteriorly, where they are set off by sharp carina that runs back along the margin of the lateral lobe; areolet always present; nervellus always strongly reclivous with the discoidella at or near the upper end; clypeus broadly truncate or arcuate at apex, rarely with a distinct median notch-like emargination..... 7.
- Ovipositor compressed, or if cylindrical it is very long and slender or upcurved; all claws either with or without basal lobes or teeth; notauli strong, rarely weak, or entirely wanting, but never defined as above..... 8.
7. Dorsal margin of lance straight to apex; propodeal spiracle slit-like, the surrounding carina prominent, separated from anterior margin of propodeum by less than its length; notauli subparallel, terminating abruptly posteriorly; polished, with abdomen impunctate; species usually largely bright ferruginous or yellowish; (secondary parasites), fig. 7..... *Theroniini*.

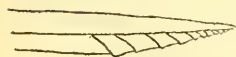


FIG. 7.—APEX OF OVIPOSITOR OF *Theronia fulvescens* CRESSON.

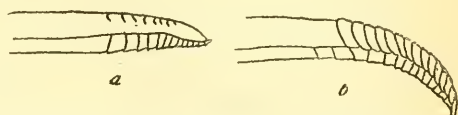


FIG. 8.—APICES OF OVIPOSITORS: a, *ITOPLECTIS CONQUISTOR* (SAY); b, *APECHTHIS PICTICORNIS* (CRESSON).

Dorsal margin of lance either decurved near apex or it is flattened at apex; propodeal spiracle usually round to long oval, rarely slit-like, and usually separated from anterior margin of propodeum by at least its length; notauli when strong complete and convergent posteriorly; species usually black or blackish with abdomen distinctly punctured, seldom both pale and with abdomen polished impunctate; (internal parasites of Lepidopterous pupae), fig. 8..... *Ephialtini*.

8. Hypopygium very large, vomeriform, acute at apex, very heavily chitinized; clypeus broadly truncate at apex, frequently sharply inflexed and with a more or less distinct median tooth; labrum exerted, (parasites on wood-boring larvae), fig. 9.....*Aconitini*.

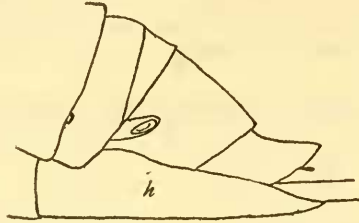


FIG. 9.—APEX OF ABDOMEN OF FEMALE OF COLEOCENTRUS OCCIDENTALIS CRESSON.

- Hypopygidium not as above, usually retracted far from apex of abdomen, very rarely (*Clistopyga*) reaching apex..... 9.
9. Occipital carina obsolete or interrupted dorsally; mesoscutum and scutellum transversely rugose throughout; apical tergite greatly lengthened; (external parasites on wood-boring larvae).....*Rhyssini*.
- Occipital carina complete; mesoscutum and scutellum not transversely rugose, at most the scutum is rugulose; apical tergite only rarely greatly lengthened. 10.
10. Abdomen inserted above, frequently far above, the hind coxae; first tergite narrow throughout; head transverse; occiput narrow, barely concave; temples short and strongly convexly sloping; eyes emarginate within; propodeum nearly straight and horizontal from base to insertion of abdomen; hind coxae long, slender and nearly uniform in diameter, fig. 10.....*Labenini*.



FIG. 10.—AREOLET OF LABENA GRALLATOR (SAY).



FIG. 11.—AREOLETS: a, TROMATOPIA RUFOVARIATA (CRESSON); b, ITOPLECTIS CONQUISSOR (SAY); c, EPIURUS ALBORICTA (CRESSON).

- Not agreeing entirely with above, fig. 11..... 11.
11. Abdomen sessile (not distinctly tapering from spiracles to base and with prominent anterior lateral angles), very rarely (*Perithous*) clavate and slightly compressed at apex; areolet usually defined; claws rarely without basal tooth; (external parasites on lepidopterous, coleopterous, and hymenopterous larvae and pupae, or in spider egg-sacs), fig. 12.....*Ichmeumonini*.



FIG. 12.—SESSILE FIRST TERGITE OF PERITHOUS PLEURALIS CRESSON.

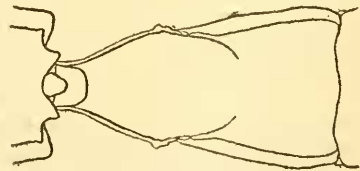


FIG. 13.—PETIOATEL FIRST TERGITE OF XORIDES YUKONENSIS (ROHWER).

- Abdomen petiolate (tapering from spiracles to base, and without prominent anterior lateral angles), clavate to subcylindrical and more or less compressed apically; areolet usually wanting; claws without basal tooth; temples broad; (external parasites on wood-boring larvae), fig. 13..... 12.

12. Mandibles edentate at apex, rarely with a small entodorsal tooth; legs slender, fig. 14..... *Xoridini*.



FIG. 14.—MANDIBLE OF *POEMENIA AMERICANA* (CRESSON).

Mandibles bidentate at apex, the teeth subequal in length; legs stout. *Odontomerini*.

KEY TO TRIBES.

1. Abdomen inserted above, frequently far above, the hind coxae, first tergite narrow throughout; head transverse; occiput narrow, completely margined, barely concave; temples short and strongly convexly sloping; eyes emarginate within; propodeum nearly straight and horizontal from base to insertion of abdomen; hind coxae long, slender and nearly uniform in diameter; thoracic dorsum not at all transversely rugose..... *Labenini*.
Not agreeing entirely with above..... 2.
2. Mandibles edentate or with a much shorter entodorsal tooth; first tergite petiolate, spiracles before middle; areolet usually wanting; thorax depressed, mesopleura distinctly longer than high; head subquadrate; notauli complete or nearly so. *Xoridini*.
Mandibles bidentate apically, teeth subequal or upper tooth longer..... 3.
3. Occipital carina wanting or interrupted medially; mesoscutum and scutellum transversely rugose throughout; abdomen inserted rather high or propodeum, occasionally far above insertion of hind coxae; first tergite with spiracles before middle and shorter than or subequal to second, which is parallel-sided. *Rhyssini*.
Occipital carina complete; mesoscutum and scutellum not transversely rugose, at most the mesoscutum partially rugoluse..... 4.
4. Abdomen distinctly compressed in apical third or half, (deeper than broad). *Acocentini*.
Abdomen not distinctly compressed..... 5.
5. Abdomen petiolate; head subcubical, swollen below antennae, not, or scarcely, narrowing behind eyes; eyes small and placed well forward, cephalo-candad length of posterior orbits longer than or subequal to that of eye; thorax and propodeum depressed, the latter very long dorsally, short posteriorly; legs, especially the femora, stout; areolet wanting. *Odontomerini*.
Not entirely as above, though rarely agreeing with one or two characters..... 6.
6. Tergites, at least 2-4, with oblique furrows which converge anteriorly until they approximate in the dorsal middle..... 7.
7. Tergites without such furrows..... 8.
7. Tergites 1-5 in male, 1-4 in female, with apical transverse impressions which together with oblique impressions set off a median, transverse, sub-triangular area; malar furrow present; first tergite with dorsal carinae short; scutellum carinate laterally to apex; intercubitus nearly or quite twice as long second abscissa of cubitus; nervellus strongly inclivous..... *Lycorini*.
First tergite without either oblique or transverse impressions, and with dorsal carinae extending beyond middle; other tergites usually without transverse apical furrows; ¹scutellum not carinate laterally; intercubitus not nearly twice as long as second abscissa of cubitus; nervellus reclivous, perpendicular, or slightly inclivous..... *Glyptini*.

¹None of the North American Glyptini have the transverse furrows, but the South American genus *Zaglyptomorpha* Viereck has them on tergites 2-5. This genus, however, has none of the other characters of the *Lycorini*.

8. Tergites beyond first without either furrows, depressions, or elevated areas; dorsal carinae of first tergite defined at most only very briefly at base (in difficult species the spiracles of first tergite are very close to the base), mesoscutum anteriorly usually with a cuneiform pale spot on each side..... 9.
- Tergites beyond first with more or less distinct elevated areas, depressions, or furrows or combinations of or all of these factors; dorsal carinae of first tergite distinct and setting off of a distinct basal concave area (in the very rare difficult species the spiracle of the first tergite is far from the base)..... 10.
9. Propodeum entirely without carinae; claws strongly curved, with few (about 6) very long, closely set teeth; entire body smooth, at most very minutely punctate.....*Phytodietini*.
- Propodeum usually with at least an apical transverse carina, rarely without carinae; claws long, weakly curved and if pectinate the teeth are smaller, more numerous, or sparsely set; at least the thorax dorsally and propodeum distinctly sculptured.....*Lissonotini*.
10. Propodeal spiracle slit-like, the surrounding carina prominent, separated from the anterior margin of the propodeum by less than its length; notauli subparallel ending abruptly posteriorly; body smooth and shining, mostly bright ferruginous or yellow; propodeal carinae very strong and high.....*Theroniini*.
- Propodeal spiracle round or elongate the surrounding carinae not prominent, removed from the anterior margin of the propodeum by at least its length; notauli obsolete or converging posteriorly; usually sculptured and dark colored, occasionally ferruginous or polished, but rarely both; propodeal carinae obsolete or weak, at least not very high and strong..... 11.
11. Notauli weak or absent; or if very strong and complete they are deep and pitlike anteriorly and set off by a sharp carina that runs back along the lateral margin of the mesoscutum;¹ head set very close to prescutum; mesopleural furrow straight or curved but not angulate opposite the punctiform fovea...*Ephialtini*.
- Notauli usually deep, at least anteriorly; the anterior margin of the mesoscutum distinctly trilobed; head, by reason of the longer pronotum, set off from the prescutum; mesopleural furrow angulate opposite punctiform fovea.... 12.
12. Notauli strongly impressed throughout, prescutum very prominent (if notauli are not strongly impressed, as in *Hymenoepimecis*, the prescutum is nevertheless very prominent and the other characters are especially well marked); temples flat or slightly convex, sloping to the strong occipital carina; face converging below and at least as long as wide at clypeus, the latter convex or slightly flattened, usually rounded at apex and with a reflexed margin, rarely (*Hymenoepimecis*) very weakly, broadly emarginate, never medially impressed or inflexed; mandibles narrow at apex, upper tooth distinctly the longer; scutellum elevated and compressed from the sides; areolet very rarely defined.
Polysphinctini.
- Notauli rarely complete, weakly impressed posteriorly, prescutum not especially prominent (if complete and prescutum prominent, as in *Chistopyga*, the insect differs radically in other characters); temples usually strongly rounded; very rarely flat, less sharply sloping; face usually wider than long; clypeus usually medially impressed and emarginate at apex, sometimes inflexed and truncate or very weakly emarginate; teeth of mandibles subequal in length; scutellum broad, convex, or flattened; areolet usually complete, occasionally wanting or incomplete.....*Ichneumonini*.

¹ None of the Holarctic genera have the notauli strong, the genera in which they are strong being principally oriental.

Tribe LISSONOTINI.

As here defined this tribe includes most of the genera placed there by Ashmead and other writers. Of the Nearctic and Palearctic genera *Hybophanes* Foerster and *Phytodietus* Gravenhorst are excluded. *Hybophanes*, we agree with Thomson, is a Tryphonine belonging in the subtribe Thymaridina, tribe Mesoleptini; *Phytodietus* forms the new tribe Phytodietini; while *Phidias*, unknown to us except from descriptions and Vollenhoven's figure, will very likely not run here, and probably should be referred to another subfamily.

The group is very homogeneous, and when once understood is easily recognized. It is very closely allied, especially through *Arenetra* Holmgren, to the Banchini as represented by *Exetastes* Gravenhorst and its nearest allies. The males of some of the Lissonotine genera are likely to be confused with males of the Tryphonines and apparently certain portions of that very heterogeneous subfamily are rather closely related to the present tribe. Within the subfamily as here treated its closest relative is the Glyptini, the abdominal structure being the only real difference, and these two tribes form a group not at all closely related to the rest of the subfamily.

GLYPTINI, new tribe.

The tribe Glyptini is founded for the genus *Glypta* Gravenhorst and its allies, *Teleutaea* Foerster, *Diblastomorpha* Foerster, and *Conoblasta* Foerster. *Ctenochira* Foerster, and *Hoplitophrys* Foerster are unknown to us, but apparently belong here. All of these genera have heretofore been referred to the tribe Ichneumonini.

The remarks above concerning the affinities of the Lissonotini apply in large part to the Glyptini.

LYCORINI, new tribe.

As here defined this tribe includes of described genera only *Lycorina* Holmgren and *Toxophorooides* Cresson. These genera have heretofore been placed in the tribe Ichneumonini, to which they are perhaps more closely allied than to the Glyptini, with which the structure of the tergites superficially allies them. The real affinities of the tribe are very obscure.

PHYTODIETINI, new tribe.

The only genus known to us that is referable here is *Phytodietus* Gravenhorst, heretofore placed in the Lissonotini. Although superficially resembling the Lissonotini it is doubtful if it is closely allied to that tribe. It may be that it has some affinity with the Lycorini, and the ovipositor suggests the possibility that they may have had a common origin with the Cryptinae.

THERONINI, new tribe.

Heretofore the genera of this tribe have been placed in the Ichneumonini. As here defined but two genera, *Theronia* Holmgren and *Neotheronia* Krieger, occur in the Holarctic fauna. In the tropical regions certain other allied genera occur.

In the form of the ovipositor and the secondarily parasitic habit the Theroniini are very distinct, though probably more closely allied to the following tribe, Ephialtini, than to any of the other tribes.

EPHIALTINI, new tribe.

The type genus of this tribe is *Ephialtes* Schrank (= *Pimpla* Authors and *Pimplidea* Viereck)¹ while the other genera are *Itopectis* Foerster and *Apechthis* Foerster, in addition to several tropical and oriental genera, such as *Xanthopimpla* Saussure, *Echthromorpha* Holmgren, and *Allotheronia* Ashmead.

Except in superficial facies the Ephialtini are very distantly related to the Ichneumonini, to which the genera have almost universally been referred.

POLYSPINCTINI, new tribe.

This tribe is erected for the genera *Polyspincta* Gravenhorst, *Aerodactyla* Haliday, *Colpomeria* Holmgren, *Zatypota* Foerster, and *Hymenoepimecis* Viereck, all heretofore assigned to the Ichneumonini.

Their very peculiar habits ally them much more closely than to any of the other tribes of the Ichneumoninae to certain of the Tryphoninae, such as *Monoblastus* Holmgren and *Polyblastus* Hartig. We believe that the facies and biological affinities exhibited by these two groups is of much greater importance as indication of relationship than are the superficial characters of form of abdomen and length of ovipositor.

The following six tribes we believe form the true Ichneumoninae. All are externally parasitic and each is related by more or less intermediate genera or by common characters of structure and habitus to one or more of the others.

Tribe LABENINI.

Ashmead was the first to recognize this group as a tribe, but in his classification he included also the Ophionine genus *Nonnus* Cresson. As defined here the tribe includes, of described genera, only *Labena* Cresson and *Grotea* Cresson.

RHYSSINI, new tribe.

The only author to treat this group as of tribal rank is Morley, other authors having placed the genera comprising it in the Ichneu-

¹ See Cushman and Rohwer, Proc. Ent. Soc. Wash., vol. 20, (1918) 1919, p. 185.

monini. The only described genera occurring in this region which belong to this tribe are *Rhyssa* Gravenhorst and *Megarhyssa* Ashmead, but in other parts of the world others occur, and all the genera treated by Morley in his tribe Rhyssides appear to belong to the Rhyssini as here defined.

Through *Apechoneura* Kriechbaumer it is related to the Labenini, and, through certain genera of the Xoridini and Ichneumonini to those tribes.

Tribe ACOENITINI.

As here restricted this tribe embraces only those genera which, in the female, have the hypopygidium very long vomeriform and polished. In the Holarctic fauna this includes, of the genera which we have examined, only *Arotus* Gravenhorst, *Coleocentrus* Gravenhorst, *Acoenites* Latreille, *Phaenobolus* Foerster, and *Mesoclistus* Foerster.

Of the genera placed in this tribe we have not had opportunity to examine *Asthenomeris* Foerster. The type of *Asthenomeris* has never been described; but according to Schmiedeknecht the genus is intermediate between the Acoenitini and Banchini. *Crypturus*, synonymous with *Endurus* Rondani, was transferred by Schmiedeknecht to the Tryphoninae, where it forms his subtribe Endurina of the tribe Mesoleptini. This treatment of the genus seems to us the logical one.

Leptobates Gravenhorst and *Procinctus* Foerster we place with the Banchini; *Aphanorhoptrum* Foerster with the Tryphonini, where it is closely allied to *Stilbops* Foerster, removed thence from the Ichneumonini; and *Collyria* Schiødte to the Mesoleptini, where it would form a distinct subtribe.

In biological habits and ovipositor and clypeal characters, together with somewhat similar general form, this tribe is most closely allied to the Rhyssini.

Tribe XORIDINI.

The tribe Xoridini of previous classifications is a very heterogeneous group. As here restricted it includes of the Holarctic fauna the genera *Deuteroxorides* Viereck, *Xorides* Latreille *sensu latiori* (= *Xylonomus* Gravenhorst), and *Poemenia* Holmgren (= *Calliclisis* Foerster).

The genera *Echthrus* Gravenhorst, *Nyxeophilus* Foerster, *Helcostizus* Foerster, *Xylophururidea* Viereck, (= *Cryptoideus* Ashmead), and *Xylophrurus* Foerster we exclude entirely from the subfamily, placing them in the Cryptinae.¹ *Odontomerus* Gravenhorst and *Aplomerus* Provancher are removed to form the allied tribe Odontomerini. *Helcostizidea* Rohwer, originally placed by its author in

¹ See Cushman, Proc. U. S. Nat. Mus., vol. 55, 1919, p. 536.

the Xoridini, we are agreed is Campopligrine and allied to *Pyracmon* Holmgren.

Through *Deuterozorides* the Xoridini are related to the Rhyssini and through *Xorides* to the Odontomerini.

ODONTOMERINI, new tribe.

Erected for the genera *Odontomerus* Gravenhorst and *Aplomerus* Provancher, this tribe is most closely related to the Xoridini, especially to the genus *Xorides* Latreille.

Tribe ICHNEUMONINI.

From this tribe as treated by Ashmead we have withdrawn the genera constituting the tribes Rhyssini, Lycorini, Glyptini, Polysphinctini, Theroniini, and Ephialtiini. Of the Nearctic and Palearctic genera that remain we have had no opportunity to examine specimens of the following: *Troctocerus* Woldstedt, *Atractogaster* Kriechbaumer, *Opisorhyssa* Kriechbaumer, *Idiogramma* Foerster, *Tromera* Foerster, *Eremochila* Foerster, and *Panteles* Foerster. *Stilbops* Foerster, *Dyspetes* Foerster, *Schizopyga* Gravenhorst and *Polysphinctomorpha* Ashmead, are in our opinion Tryphonine, the first belonging to the Tryphonini, the second to the Mesoleptini, and the third to the Exochini; while *Polysphinctomorpha* is Mesoleptine and synonymous with *Neliopisthus* Thomson.¹

Through *Pseudorhyssa* Merrill this tribe is rather closely allied to the Rhyssini.

¹Cushman, Proc. U. S. Nat. Mus., vol. 56, 1919, p. 378.